SOME

EXPERIMENTS

ON THE

CHALYBEAT WATER,

Lately diſcovered, near the Palace of the
Lord BISHOP of ROCHESTER, at
BROMLEY, in Kent,

WITH

OBSERVATIONS on CHALYBEAT WATERS in
general, and the moſt SUCCESSFUL METHOD
of drinking them: in which an Expedient is
offered, to reconcile the different Opinions of
Dr. HOFFMAN and Dr. SHORT, concerning
the Exiſtence of ALKALINE SALTS, in thoſe
Chalybeat Waters, which are commonly but
improperly called ACIDULÆ,

WITH

Some plain and eaſy Directions to make ARTIFICIAL
Chalybeat Waters; and to diſtinguiſh, with abſolute
certainty, the FACTITIOUS from the NATIVE.

To which are added,

Some Directions for diſcovering the unwholſome Contents of
COMMON WATER; and ſome Methods of correcting them,
ſo as to render them more ſafe for ALIMENTARY PURPOSES.

C

By THOMAS REYNOLDS, Surgeon.

> " With ſuch [Water] doth HE heal Men, and taketh
> " away their Pains. ECCLES. XXXVIII. 7.

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MDCCLVI

TO

JOSEPH WILCOX, Esq.

SIR,

AS the public was under great obligations to the benevolence of the late Lord Bishop of Rochester, your Father, for that excellent Chalybeat water which is the ſubject of the following Experiments; I, as a partaker of the common benefit, had dedicated them to him in teſtimony of my gratitude and reſpect: but it having pleaſed the Almighty and moſt Merciful Father of Spirits, to remove him into a ſuperior ſtate of exiſtence while theſe ſheets were in the preſs, I could not but conſider them as yours by a kind of natural right: as ſuch, therefore, they are preſented to you, by,

Sir,

Your moſt obedient

humble Servant,

Thomas Reynol

PREFACE.

WHEN I began to make the following Experiments, my view was only to examine the contents of the Water of the Chalybeat Spring at Bromley, *without any deſign of publiſhing the reſult of them, whatever it might be.*

BUT as, in the courſe of my inquiries, ſome circumſtances occurred, which appeared to me to be repugnant to the common opinion concerning Chalybeat Waters in general, and which, ſo far as I know, have not been taken notice of by any other perſon, I was induced to print them.

WHAT I have ſubjoined with reſpect to perſeverance in the uſe of Chalybeat Waters, during little paroxiſms of an irregular gout; and the preference I give to the winter ſeaſon for drinking them in general; I have found by experience to be attended with very good ſucceſs, though not authorized by the preſent practice: this part, therefore, is intended for the benefit of thoſe, who having occaſion, may think fit to follow my example.

THE directions which I have given for making artificial Chalybeat Waters; the deſcriptions of the common methods of ſophiſticating the genuine, when they are injured by keeping; and the means by which thoſe frauds may be *eaſily and certainly detected; will, I hope, be thought worthy of ſome conſideration.*

I WOULD by no means have it underſtood, that I think there is any thing new in the directions I have given for diſcovering the contents of common water; in the rationale of the experiments therein mentioned; or in the directions for the choice of the moſt wholeſome water for drinking. But, as the knowledge of theſe things is almoſt intirely confined to the profeſſors of phyſic, who are few; and yet is of great importance to the tender and valetudinary, who are many; I hope I ſhall incur no cenſure, by this attempt to make it more general: at leaſt, I hope, what I have ſaid under theſe heads, may be permitted to ſerve as an introduction to that excellent tranſcript from Dr. MEAD*'s book, which, it were to be wiſhed, for the good of mankind, was much more public than it is.*

TO conclude: if any thing in this little book, ſhall prove in any degree uſeful to my fellow creatures, it will proportionably anſwer the intention and wiſhes of the author.

EXPERIMENTS
ON THE
Chalybeat Water,
Lately diſcovered at
BROMLEY in *KENT*.

THE Chalybeat Water, on which the following Experiments were made, ariſes at the foot of a declivity, a very ſmall diſtance, eaſtward, from the palace of the Lord BISHOP of ROCHESTER, at Bromley in Kent. The ſoil, through which it paſſes, is gravel; and it iſſues immediately from a bed of pure white ſand. The courſe of the ſpring ſeems to be about north-north-eaſt and ſouth-ſouth-weſt: its opening is towards the ſouth-ſouth-weſt; and as Shooters-hill bears about north-north-eaſt from its aperture, it probably comes from thence. It was diſcovered in September MDCCLIV, by the reverend Mr. Harwood, his Lordſhip's domeſtick chaplain, by means of a yellow ochrey ſediment, remaining in the track of a ſmall current, leading from the ſpring to the corner of the moat, with the waters of which it uſed to mix.

It is very probable, that this ſpring has been formerly frequented; for in digging about it, there were found the remains of ſteps leading down to it made of oak plank, which appeared as if they had lain under ground a great many years.

When his Lordſhip was acquainted that the Water of this Spring had been examined, and found to be a good Chalybeat, he, with great humanity, immediately ordered it to be ſecured from the mixture of other waters, by ſkilful workmen, and encloſed in a circular brick-work like the top of a well; in hopes, that it might prove beneficial, as a medicine, to ſuch as ſhould think fit to drink it.

This order was ſpeedily and effectually executed, and the Water not only ſecured but the acceſs to it made very commodious to the Public, by the generous care, and under the inſpection of Mr. Wilcox, his Lordſhip's ſon. And their benevolent intentions have already been anſwered with ſucceſs: for great numbers of people, of all conditions, but chiefly of the midling and poorer ſort, drink daily of this excellent water, many of whom have been remarkably relieved from various infirmities and diſeaſes, which were not only afflicting but dangerous.

Experiment I.

Into two ounces of the Chalybeat Water from the Biſhop's Well, I put a quarter of a grain of powdered galls: it ſoon changed to a blueiſh purple; and growing higher and higher, it ended in an exceeding rich tranſparent elegant purple, inclining to a violet colour, which did not ſubſide on ſtanding twenty-four hours.

N. B. This water was at firſt of a blueiſh caſt; which, upon enquiry, I found to be occaſioned by a great quantity of oak leaves having fallen into the well, as it was at that time without a cover.

EXPERIMENT II.

Into two ounces of the ſame water I dropped two drops of Liquamen Tartari, which immediately formed greeniſh clouds, that on ſtanding inclined more and more to a yellow, and, at length, depoſited a fœculent ſediment of an iron-mole colour.

EXPERIMENT III.

Into the like quantity of the ſame water, I dropped two drops of Ol. Sulph. per Campanum: the water, which before was blueiſh, immediately became very bright and limpid, and remained ſo without any ſediment: after it had ſtood ſome time, a great many very ſmall air bubbles aroſe to the ſurface, and many alſo remained fixed to the bottom and ſides of the glaſs.

EXPERIMENT IV.

I put a portion of the ſame water into a glaſs without any mixture, and by ſtanding till next day it depoſited an ochrey ſediment, in the form of a very fine yellow calx, adhering to the bottom and ſides of the glaſs; an oily bituminous ſcum formed itſelf on the top of the water, and ſome ſmall air bubbles were ſeen on the bottom and ſides of the glaſs. The water in this ſtate did not change colour with the mixture of powdered galls.

EXPERIMENT V.

I boiled two ounces of the ſame water in a ſmall ſilver veſſel: it depoſited a yellow ſediment as in the foregoing Experiment; and the ſame oily ſcum formed itſelf on the top of the water while it was yet hot, but more copiouſly after ſtanding till it was cold. The water, when poured off into a clean glaſs, in this Experiment, was milky; whereas, in the former, it was quite limpid. It ſuffered no change of colour, by the mixture of powdered galls; nor did it in this, or the former Experiment, retain any of its natural ferruginous taſte, after a ſeparation of its ochrey ſediment, and its oily ſcum. By this and the former Experiment, I conclude that the mineral contents of this water are wholly volatile.

EXPERIMENT VI.

A ſmall quantity of this water freſh taken up from the ſpring, very readily diſſolves common cake-ſoap, and eaſily makes a very ſtrong lather with it. But when it has ſtood till the volatile ſpirit is evaporated, and the ſeveral mineral contents are ſeparated from each other, it requires much more trouble to make it diſſolve ſoap.

EXPERIMENT VII.

Two ounces of this water freſh taken up, immediately turned green by an effuſion of ſyrup of violet.

EXPERIMENT VIII.

The ſame water being boiled, and filtered through paper, was turned to a more bright and elegant green with ſyrup of violet.

EXPERIMENT IX.

Two ounces of the ſame water, as in the foregoing Experiment, immediately turned milky with two drops of a ſolution of copall'd ſilver in aqua fortis: by ſtanding a little, it formed browniſh clouds, and afterwards depoſited a ſediment of the ſame colour.

EXPERIMENT X.

Two ounces of the ſame water turned alſo very milky, with two drops of a ſolution of

Sacch. Saturni; and by ſtanding depoſited a very copious white ſediment.

EXPERIMENT XI.

I had three quarts of this water taken up at the ſpring, in the very coldeſt weather, *viz.* on the 7th of February, 1755; when, by reaſon of the extreme hard froſt the mineral contents of this water muſt be in the moſt concentrated ſtate: it was taken up in a retort, the mouth of which was very carefully ſtopped inſtantly with a very ſtrong cement; and with all poſſible caution a receiver was fitted to the retort, and cemented in the beſt manner; and then it was ſet in a ſand heat for diſtillation. A few ounces of what came firſt over, was with the utmoſt attention ſeperated from the reſt, and preſerved very carefully in a phial well corked and ſealed, in order to examine its contents; and it did not ferment or effervеſce, either with acid or alkaly: it gave no green colour with the mixture of ſyrup of violet; nor with the powder of galls did it turn purple: it did not ſuffer any alteration in the colour, by a ſolution of ſilver in aqua fortis, nor by oil of Tartar, nor by a ſolution of Sacch. Saturni; but remained quite pellucid and clear as cryſtal: it was altogether inodorous and perfectly taſteleſs; and in all reſpects like pure diſtilled, or rain water.

EXPERIMENT XII.

I took about a quarter of a grain of pure Ochre, ſeparated from this Chalybeat water by a filter, and diſſolved it in a few drops of Spirit of Vitriol, with which it fermented, but not very ſtrongly: then I added about two ounces of common pump-water to it, and a very ſmall quantity of powdered galls; and after neutralizing the acid with Liquamen Tartari, it gave a very full purple, inclining to a black, which very ſoon ſeparated into grumous concretions, and depoſited a very copious dark blackiſh ſediment, leaving the clear of a very elegant, but dilucid purple colour.

EXPERIMENT XIII.

A portion of ſalt obtained from the ſame water by evaporation, after it had paſſed the filter, together with ſuch calcarious matter as paſſed with it, fermented much more violently with Spirit. Vitrioli, than the Ochre mentioned above.

EXPERIMENT XIV.

Into two ounces of mineral water, I put two drops of Spirit of Vitriol, and ſtirred it about, that it might uniformly mix with the water: then I added a quarter of a grain of powdered galls, which produced no change of colour: then I neutralized the acid, by adding three drops of Liquamen Tartari, and it immediately

mediately gave the ſame elegant purple colour, that the like quantity of this water, with an equal portion of powdered galls, without any other mixture, will do: whereas the Tunbridge-well water, with the ſame treatment, gives a dirty untranſparent reddiſh colour, as Dr. HALES obſerves, and I alſo have experienced by many repeated trials. Dr. Jurin ſays, that Iſlington waters alſo, when mixed with acids, and neutralized with alkalies, gave a turbid untranſparent reddiſh colour; and, therefore, that he would not venture to preſcribe or adviſe the uſe of Chalybeat waters, which had been mixed with acids, and neutralized with alkalies, becauſe ſuch an alteration being made in the ſenſible qualities of the mineral water by that proceſs, it was in his opinion uncertain what effects it might produce.

Now, if Dr. Jurin had no other objection to the internal uſe of Chalybeat waters that had been acidulated, and then neutralized with alkalies, but the difference of the colour they produce with galls, from that which is produced by the ſame water freſh taken from the ſprings; it is intirely obviated in regard to the Bromley water; for that ſuffers no alteration by ſuch a proceſs, but gives the ſame elegant tranſparent purple colour, after being acidulated and neutralized, as it does with galls when it is firſt taken up at the ſpring.

EXPERIMENT XV.

Into two ounces of Chalybeat water, I dropped four drops of Oil of Tartar, in order to precipitate its contents; and after ſtanding two days, I found all the Ochre was depoſited at the bottom and ſides of the glaſs. I then poured off the water, which was quite limpid, into another glaſs, and dropped into it ſome drops of Spirit of Vitriol, to neutralize the Oil of Tartar, and then mixed the uſual portion of powdered galls with it; but no purple colour was produced after ſtanding twenty four hours. I then dropped four drops of Spirit of Vitriol on the precipitated mineral contents, and it very ſoon diſſolved that yellow coagulum, which Oil of Tartar always produces in Chalybeat water by precipitation, and changed it into a tranſparent fluid. I then added two ounces of rain-water, that was very pure, to the mixture, and it ſtill remained cryſtal-clear, after galls had been mixed with it more than an hour. I then dropped into it ſome drops of Oil of Tartar, and it immediately gave the ſame elegant purple colour as this water does with galls, when it is firſt taken up at the ſpring.

Remark: By this Experiment it appears, that the tinging virtue of this mineral water conſiſts wholly in its Ochre being kept in an attenuated ſtate.

EXPERIMENT XVI.

I took half a grain of the Ochre of the Bromley Chalybeat water, collected by filtration, and diſſolved it with a ſew drops of Spirit of Vitriol: I then poured on it an ounce of rain water collected from the ſpouts, and let it ſtand till I judged the Ochre to be perfectly diſſolved; then poured the clear diſſolution into a large glaſs, and poured on more rain water, till I judged the whole to be about twelve ounces: I then put in the proper quantity of galls, and afterwards dropped in ſome Oil of Tartar to neutralize the acid, and it immediately gave the whole mixture the ſame elegant colour as in the foregoing Experiment.

N. B. There remained at the bottom of the ſmall glaſs where the diſſolution was made, ſomething more than a fourth part of what I took to be Ochre undiſſolved, which, upon examination, I found to be a gritty ſubſtance that was not diſſoluble by the acid ſpirit; and this gritty matter was, I ſuppoſe, collected in the filtre as it ſtood in a common room.

Remark. By this Experiment it appears, that ſomething leſs than half a grain of Ochre is contained in a pound of this mineral water.

In repeating this Experiment ſeveral times, I had always much about the ſame quantity of indiſſoluble gritt; and the like quantity of water always produced the ſame elegant colour from the ſame quantity of Ochre diſſolved.

EXPERIMENT XVII.

I dropped four drops of juice of lemon into a wine glaſs of Chalybeat water, and let it ſtand uncovered in a room where a fire was conſtantly kept for twenty four hours. This ſmall quantity of acid kept the water limpid without any precipitation of its contents. On mixing powdered galls with it, the water immediately changed of a fine carmine colour, which grew by degrees darker, till it ended in an extremely fine purple, though ſomewhat redder than the ſame water, freſh from the ſpring, gives with powdered galls. Six drops of the juice of a Seville orange in the like quantity of water, taken up at the ſame time, produced the ſame effects in all reſpects: ſo that probably this ſmall quantity of lemon or orange juice may render this water portable to ſome ſmall diſtances from the ſpring, in pretty good condition; and in this proceſs there is no need of neutralizing the acid, for it does not ſuſpend the tinging virtue of the water.

EXPERIMENT XVIII.

July 10*th*, I took two quart bottles marked numb. 1, and numb. 2. In numb. 1, I put two ſcruples of Sal Armoniac; in numb. 2, I put two ſcruples of Sal Diureticus; then filled both with Chalybeat water at the well, ſtopped them cloſe, and ſet them in a cool cellar. On the 16th following I tried them both with galls, when number 1 gave a very faint red, and number 2 as high a purple as when firſt taken up, but with ſomewhat a redder caſt. On the 24th, I tried them both again, when number 1 gave no change of colour at all with galls; number 2 ſtruck a colour as high as Burgundy, and gave a very conſiderable red on the fourth of Auguſt. But though the tinging virtues of theſe waters may be, by theſe means, preſerved ſome little time; yet as the taſte and ſmell of them ſo kept, are ſo very different from thoſe of the ſame water when firſt taken up at the ſpring, I am of opinion, that they are then no better than artificial Chalybeat water, which will more plainly appear hereafter: I therefore did not endeavour to preſerve them, by any other method of medicating them. But if the reader is deſirous to know, how far it is practicable to preſerve them by mechanical means without any mixture, he may be fully ſatisfied by peruſing ſome experiments publiſhed by that very accurate obſerver the Reverend Dr. HALES, whoſe extenſive knowledge of nature has furniſhed him with many ingenious expedients for that purpoſe.

EXPERIMENT XIX.

I diſſolved ten grains of the groſs ſediment of the water of the Bromley well, evaporated to a dryneſs in an ounce of pure rain water; and on ſtanding ſome time the ſolution became clear, and had depoſited a good portion of an argillaceous abſorbent earth of the colour of blue marl, which efferveſced with Spirit of Vitriol. I filtered the clear diſſolution, and ſet it to cryſtallize, and obtained a ſaline ſubſtance of a dark iron-mole colour, which became moiſt by being expoſed to the air : in it were ſome cryſtals, which in taſte and form much reſembled thoſe of ſea ſalt, but differed from it a little in both ; *i. e.* the taſte of the cryſtals was more bitter, and the form of them more irregular, than thoſe of ſea ſalt. Some of the whole concrete ſaline ſubſtance put on a hot iron, aroſe in bliſters ; but not near ſo much as the like quantity of allum did : the matter when calcined upon the iron, taſted ſalt and pretty auſtere ; with a kind of acrimony reſembling that of burnt feathers, or animal ſubſtances of the like kind.

EXPERIMENT XX.

I took ſome of the ſmall cryſtals, obtained as in the preceding Experiment, and ſeparated them as carefully as poſſible from the Ochre that paſſed the filtre with the ſalt ; (for as the water had been boiled for another experiment, before the Ochre was ſeparated from it, the Ochre was ſo attenuated by the heat, that it accompanied and adhered to the ſalt, ſo as to tinge it brown, like ſugar-candy, notwithſtanding it had paſſed a double filtre.) Thoſe cryſtals did not riſe in bliſters on a hot iron, like allum ; nor crepitate like ſea ſalt ; nor fuſe or ſcintillate, like ſalt-petre ; nor give a urinous ſmell, or dark brown ſmoak, like Sal

Armoniac: but dried away to a dark brown or blackiſh cinder, emitting a vapour ſcarce perceptible; and when burnt, the calx taſted pretty ſalt, with a remarkable roughneſs or ſtypticity.

EXPERIMENT XXI.

I took ſome cryſtals ſeparated, as above, very carefully from the reſt of the concrete, and dropped a drop of Spirit of Vitriol on them, and a very ſtrong fermentation enſued. I was much ſurprized to find ſuch a mark of an alkaline ſalt; for I had from its taſte, and other circumſtances, hitherto concluded, the ſalt contained in theſe waters to be neutral: and imagining that probably a ſmall portion of Ochre or abſorbent earth might have adhered to the ſalt, and occaſioned the fermentation before mentioned, I immediately tried the Ochre, and abſorbent earth ſeparately, with Spirit of Vitriol, and they both did efferveſce a little, but not near ſo violently as the ſalt did; and I repeated both theſe experiments a great many times, to ſatisfy the curioſity of ſeveral perſons, and the event was always preciſely the ſame. I then diſſolved a ſmall cryſtal in half an ounce of diſtilled water, and this diſſolution turned ſyrup of violet green.

EXPERIMENT XXII.

The water of the Bromley ſpring mixes with milk without curdling, in whatſoever proportion the one bears to the other; and it preſerves milk from becoming ſour. One third part of milk with two thirds of the water, kept ſweet four days and three nights, though it ſtood expoſed to the ſun in the month of Auguſt.

EXPERIMENT XXIII.

One pound, avoirdupoize weight, of the Bromley water, carefully evaporated in a ſand heat in a Florence flaſk, afforded eight grains of reſiduum of a dark cinnamon colour; which imbibed humidity from the air very plentifully, and always became moiſt when it was expoſed to its influence.

This Experiment was carefully repeated, and the event was preciſely the ſame as at firſt.

This Experiment ſhews, that the water of this ſpring is much richer in mineral contents, than the water of Tunbridge wells: for the like quantity of that water evaporated in the ſame manner, yielded but two grains and a half of ſediment, according to Dr. HALES; and the Reverend Dr. WILSON, rector of Walbrook, found, on a like trial made on a pound of the water of Tunbridge wells, that he could obtain but one grain and a half of dry remains, as is alſo mentioned in Dr. HALES's book of experiments on ſteel waters.

EXPERIMENT XXIV.

A piece of clean poliſhed ſilver ſuffered no alteration in its colour, by remaining in a glaſs of water from the Bromley ſpring 24 hours.

EXPERIMENT XXV.

The ſpecific gravity of the Chalybeat water of the Bromley ſpring exceeds, in a very ſmall degree, that of rain water, by the hydrometer: the Experiment was preciſely the ſame, when made by the hydroſtatic balance.

EXPERIMENT XXVI.

In order to diſcover nearly the quantity of iron in ſolution, in a given quantity of Bromley, Tunbridge well, or any other volatile Chalybeat water, that gives the ſame degree of colour with powdered galls; I made a ſolution of Sal. Martis in pure rain water, in the proportion of half a drachm of ſalt to one ounce of water: the Sal Martis in this ſolution, is one ſeventeenth part of the whole; and as the iron in the ſalt is eſteemed to be about one third part of its compoſition, ſo the iron on the whole ſolution will conſequently be $\frac{1}{51}$.

In ſeveral trials I found, by dropping the ſolution carefully out of a half ounce phial, that from 65 to 75 drops made a drachm, ſo at a medium I allow 70 drops to a drachm; and two drops of this ſolution will impregnate two ounces, avoirdupoize weight, of pure rain water, as highly as moſt natural volatile Chalybeat waters now in uſe.

So that, according to the foregoing calculation, ſomething leſs than a thirty-third part of a grain of iron in ſolution, will ſaturate two ounces, avoirdupoize weight, of water, ſo as to give it as ſtrong a ferruginous taſte, or as high a purple tincture with powdered galls, as moſt natural Chalybeat waters now in uſe for internal medicine; if the irony taſte, and the purple tincture it gives with galls, may be allowed a rule to judge by. But to avoid the trouble of very minute arithmetical calculation, I will call the quantity of iron contained in two drops of the ſolution, one thirtieth part of a grain; and then it will appear by this Experiment, that one ſingle grain of iron in ſolution, will impregnate three pounds and twelve ounces, avoirdupoize weight, of water, as ſtrongly with the mineral principle, as moſt natural Chalybeat waters now in uſe for drinking; upon a ſuppoſition, that one third part of the Sal. Martis is pure iron, as it is reckoned to be. But the following Experiment will ſhew that this ſuppoſition is not true.

EXPERIMENT XXVII.

I took half a drachm of the clean filings of iron, and poured upon them one drachm of the beſt Oil of Vitriol; and, to promote the diſſolution of the filings, I added half an ounce of pure rain

water:

water: and when I found, after ſtanding many days, that there yet remained ſome ſmall portion of undiſſolved matter at the bottom of the phial, I poured on half an ounce more of water, and paſſed the ſolution through a filter; and there remained in the filter ſix grains of an undiſſolved fæculent matter; which ſhews the common opinion, that Sal Martis is compounded of two thirds of Oil of Vitriol, and one third of iron, to be erroneous. Beſides, there is no manner of doubt, but a good portion of water enters the compoſition of the vitriolic cryſtals thus formed; which ſtill ſhews, that the calculation I have made of the very ſmall quantity of iron in ſolution in Chalybeat waters, in the foregoing Experiment, is far from exceeding the truth.

N. B. Two drops of the ſolution in the preceeding Experiment, gave two ounces of rain water, with galls, the higheſt colour it was capable of receiving.

I was for three years together diſappointed in many attempts to imitate the fine elegant purple colour, which natural Chalybeat water gives, with galls, by artificial mixtures; and, though I followed the directions given by Dr. MONRO, in the Edinburgh Med. Eſſays, I could very ſeldom ſucceed, and, when I did, it was by accident: for if I repeated the Experiment a few days after, with the ſame proportion of what I took to be the ſame materials, I found often very different effects. I was greatly embarraſſed to know the reaſon of my diſappointment; ſometimes attributing it to one, and ſometimes

times to another, but always to the wrong cauſe. I had obſerved I ſucceeded beſt in Experiments made with water in a ciſtern, ſaved from the ſpout, and ſometimes to my utmoſt ſatisfaction: but as at other times I had not the like ſucceſs, I was greatly perplexed to aſſign a cauſe for the very great difference of the effects produced by the ſame ingredients, mixed with what I took to be the ſame water, and thought it proceeded from the difference of winds and weather when the water was collected; till at length, upon inquiry, I found that in the ciſtern, which I had ſuppoſed contained only rain water, the ſervants were often uſed to pump well water to be ready for uſe on ſeveral occaſions: I then ſet out on a new footing, and tried the Experiment in the following manner.

EXPERIMENT XXVIII.

I provided myſelf with a ſolution of Sal Martis in ſome very pure rain water, in the proportion of half a drachm of ſalt to an ounce of water: I alſo procured ſome rain water ſaved from the drip of a houſe, ſome diſtilled water, two kinds of pump water, and ſome very pure rain water (the ſame with which the ſolution was made:) I put two ounces of each of theſe waters into a wine glaſs, and dropped into every glaſs two drops of the ſolution of Sal Martis, which I had found by experience to be ſufficient for that quantity of water: I then put a ſmall portion of powdered galls into each glaſs. The reſult was this; I had a very different colour from each of them, except the diſtilled and pure rain water, in both of which the colour was exactly the ſame, *viz.* a very pale blue, ſcarcely perceptible. The rain water ſaved from the drip of a houſe, gave an extremely fine purple, not to be diſtinguiſhed from that which a natural Chalybeat water gives with powdered galls. The two kinds of pump water gave each a different blueiſh untranſparent dirty purple, not at all reſembling the former. I was for ſome time at a loſs, to diſcover the reaſon that the diſtilled and pure rain water ſuffered ſo little alteration in their colour, with the very ſame materials that produced ſo high and elegant a purple in the rain water ſaved from the drip of a houſe; till recollecting, that the laſt probably had taken up ſome alkaline ſalts from the tyles, or ſome fuliginous ſalts from the ſmoak of the chimney, that might occaſion this difference in the effects, I dipped a probe in Oil of Tartar, and ſtirred the glaſs with diſtilled water, and the glaſs with the pure rain water alternately in the ſame manner, and, to my very great ſatisfaction, I found they both gave immediately the ſame ſplendid purple colour, that a natural Chalybeat water affords with galls. By a great number of ſubſequent Experiments, I found the event was preciſely the ſame; and by many repeated trials, the Oil of Tartar, in the proportion of one drop to ſix ounces of pure rain, or diſtilled water, and the uſual quantity of the ſolution, would always produce the ſame beautiful purple colour, that the water of Tunbridge wells, or any other good Chalybeat, will afford with powdered galls, and alſo the ſame irony taſte.

N. B. A factitious Chalybeat water made as above, will lather with ſoap, as readily as the beſt natural Chalybeat water will do, when it is freſh taken up at the ſpring.

Remark: By this Experiment it appears, that a very conſiderable quantity of iron may be in water, in a ſtate of diſſolution, without being diſcoverable by galls; and, conſequently, the common method of eſtimating the ſtrength of the mineral principle of Chalybeat waters, by the deepneſs of the purple colour they give with galls, is erroneous, and not to be depended upon. And it further appears by the foregoing Experiment, that an alkaline ſalt is a neceſſary ingredient in all volatile Chalybeat waters, to enable them to afford that extreme fine purple colour, that is conſtantly produced by them when mixed with powdered galls, while they are yet in full perfection: for I could not procure any other colour than a blue, which did not in the leaſt incline to purple, from a ſolution of Sal Martis, and pure rain water and powdered galls, without the addition of Oil of Tartar, or a ſmall portion of ſome other alkaline ſalt; though in ſeveral Experiments purpoſely tried, I put in more than ſix times the quantity of the ſolution of Sal Martis, that is neceſſary to give the like quantity of water the higheſt tincture it is capable of receiving, when the powder of galls is mixed with it.

This, with the ſubſequent Experiment, and Experiment XXI. ſeems clearly to decide a diſpute which has been much controverted, *viz.* whether there is any ſuch thing as an alkaline ſalt in any natural Chalybeat water of the ſpecies called acidulæ, or not.

EXPERIMENT XXIX.

I took five wine glaſſes, and filled them with very pure rain water. In numb. 1, I put a ſmall portion of the abſorbent earth, that had been ſeparated from the water of the Bromley ſpring; in number 2. a portion of ſea ſalt; in number 3. the like quantity of Sal Armoniac; in number 4. Sal Glauberi; in number 5. Sal Nitre. And after the ſeveral ſalts were perfectly diſſolved, and the abſorbent earth thoroughly mixed with the water, I dropped into each glaſs two drops of a ſolution of Sal Martis, made with half a drachm of ſalt to one ounce of water; and when the ſolution was mixed with the water by ſtirring, I put an equal portion of galls into every glaſs. After ſtanding one hour, numb. 1. gave a pale blue colour; numb. 2. and all the ſubſequent numbers, a paler blue, but not all in the ſame degree. When I found the mixtures did not acquire a higher colour by ſtanding, I dipped the end of a probe in Oil of Tartar, and ſtirred numb. 1. with it; and it immediately gave the ſame fine elegant purple colour, that the ſame quantity of Tunbridge well water, freſh taken up, produces with a mixture of galls.

Numb. 2. did the ſame with volatile Spirit of Hartſhorn; numb. 3. the like, with a ſmall portion of the alkaline ſalt of the Bromley Chalybeat water; numb. 4. with volatile Salt of Hartſhorn; numb. 5. with volatile Spirit of Sal Armoniac; but this laſt was bluer than either of the former, and of a paler colour.

I know it is the opinion of many learned and ingenious men, that there is no ſuch thing in nature as an alkaline ſalt, other than is produced by calcination, or ſome effect of fire equivalent to it. I ſhall not however enter into that diſpute, but refer the reader for further ſatisfaction to what is ſaid, by writers on the Materia Medica, and natural hiſtorians, of the Nitre of the ancients. I ſhall only beg leave to make this ſhort quotation from the Bible, and leave every one to think of the matter as he pleaſes: *Prov.* chap. xxv. *v.* 20: "As he that taketh away a "garment in cold weather, and as vinegar "upon nitre, ſo is he that ſingeth ſongs to an "heavy heart:" and *Jeremiah* chap. ii. *v.* 22. "For though thou waſh thee with nitre, and "take thee much ſoap, thine iniquity is mar"ked before me, ſaith the Lord." And in the Old Bible, it is "as vinegar upon lime"; and in a marginal note, the word lime is rendered, "or "ſoap, or nitre." Before I quit this ſubject, I ſhall take the liberty to offer an expedient to reconcile the different opinions of Dr. Frederick Hoffman and Dr. Short, concerning the matter in queſtion. Dr. Hoffman aſſerts, that Alkaline Salts are in all Chalybeat waters.

Dr. Short denies, that they are to be found in any. They both produce Experiments in juſtification of their opinions; and both their Experiments were ſaid to be made on Pyrmont water. Theſe Experiments are thus related in a note, in Dr. Linden's book of mineral waters. "By Dr. Hoffman's Experiment, three pints of Pyrmont water exhaled, left only 40 grains of ſediment, which he ſays was an alkaline ſalt, and fermented violently with Oil and Spirit of Vitriol. Dr. Short ſays, that from three pints of Pyrmont water, exhaled as before, he procured 72 grains of ſediment, and from thence 30 grains of a beautiful white ſalt that neither fermented with acid nor alkalies." Both theſe accounts cannot poſſibly be true, if the waters made uſe of in both Experiments were preciſely the ſame; and the characters of the perſons are a ſufficient ſecurity againſt any ſuſpicion, of their having either ignorantly or wilfully impoſed on the public: it is very reaſonable therefore to ſuppoſe, that the waters, with which thoſe Experiments were made, were not both the ſame genuine unſophiſticated Pyrmont water, as taken up at the ſpring. But Dr. Hoffman was at Pyrmont when he made his Experiment, and, as appears by his book, went thither on purpoſe to examine the water of that celebrated ſpring; from whence it may be fairly concluded, he had the pure, natural, unadulterated water. Dr. Short made his Experiment in England, and therefore it is very probable the water he procured, was medicated with ſome fixed acid, to preſerve its mineral contents in a ſtate of diſſolution; and if ſo, the different quantity of ſediment, as well as the different kind of ſalt ſaid to be obtained from the ſame water will be clearly accounted for. For ſuppoſing half a drachm of any fixed foſſil acid to be added to a three pint bottle of Pyrmont water, (which perhaps is barely ſufficient to preſerve it, conſidering the large quantity of calcarious matter, and its other mineral contents;) this addition would moſt certainly increaſe the quantity of ſediment or reſiduum, nearly equal to that mentioned by Dr. Short; and alſo neutralize any alkaline ſalt that might naturally exiſt in thoſe waters. And that this was really the caſe in regard to the water Dr. Short examined, will more plainly appear by conſidering the following particulars: Firſt, That Pyrmont water is a volatile Chalybeat, as appears by the accurate Experiment of Hoffman upon it; who found, when it was expoſed to the action of the air, in veſſels unſtopped but for a few hours, the mineral ſpirit evaporated, it became foul and vapid, depoſited its mineral contents, and was deprived of its tinging virtue with galls, juſt as the volatile Chalybeats of this kingdom, and every other, are known to do. And it is very well known, that there is no certain method yet diſcovered, of preſerving volatile Steel waters, ſo as to make them endure to be tranſported from place to place, but by mixing acids with them; nay, nor even to keep them 24 hours in any place, except in froſty or very cold weather. And tho' they are taken up in the moſt intenſe froſt, and the corks of the bottles ſecured with pitch or reſin, in the moſt effectual manner; yet when a thaw, or warmer weather ſucceeds, their volatile ſpirit immediately eſcapes, and they become turbid; a ſeparation of their mineral contents enſues, which attracting each other ſtrongly, form combinations too large to be longer ſuſpended, and are conſequently ſoon precipitated. The texture of the water being thus deſtroyed, it loſes its ferruginous taſte, and tinging virtue with galls, together with its medical efficacy; unleſs it be preſerved by acids, or ſome ſaline preparation of iron: ſo that it is highly improbable, if not impoſſible, that any foreign volatile Chalybeat waters can be imported into this kingdom, in any degree of perfection, without the aſſiſtance of art; and then they are no better than what may be made ex tempore, by any perſon, and in any place; and this conſideration is, I think, to the purpoſe. The next particular to be conſidered, is the plain confeſſion of the dealers in mineral waters themſelves, that there are ſophiſticated waters among them, which may be gathered from their advertiſements. I have now before me a certificate by way of teſtimonial, as follows:

Spa, in Germany, April 25, 1747.

This is to certify, that I, A. H. of Spa, have contracted with F---y J---ns of London, to ſell our true Pouhon water, the ſaid J---ns having engaged not to deal in any falſe water, &c. Al. H---y.

A plain indication that falſe waters are ſold in the trade, and a ſhrewd ſign alſo that Mr. J----ns had been ſuſpected to traffic that way, as Mr. H----y takes ſuch care, probably for his own reputation, to engage him not to deal in any falſe waters: for if it had not been notorious, that the public had been impoſed upon by falſe waters, ſuch a teſtimonial as this muſt have been ridiculous, as well as impolitic, as it could anſwer no other end than bringing an odium on the whole trade, by needleſſly raiſing ſuſpicions of their integrity.

The next conſideration is an implication of Dr. Short's own words; for in the abovementioned quotation, he almoſt acknowledges he has found Alkaline Salts in Chalybeat waters himſelf: for he ſays, he has found few or none of the refined Salts of thoſe ſprings, meaning Chalybeat ſprings, that would raiſe a briſk ebullition with acids: a ſtrong indication that he had found ſome of the refined Salts of the waters he examined in a natural ſtate, that would ferment with acids, in ſome degree at leaſt, though not ſo ſtrongly in his opinion as to deſerve the name of a briſk ebullition. And this is, I think, a ſtrong corroborating evidence, that the water Dr. Short employed in his Experiment quoted againſt Hoffman, was acidulated as before ſuggeſted: and if ſo, Dr. Hoffman's teſtimony of Alkaline Salts in Pyrmont water, is ſtill unſhaken; and Dr. SHORT's evidence of the kind of ſalt he found in the waters of the ſame denomination, is no leſs true. But this I offer as my own opinion only, which I ſubmit to the judgment of the candid reader.

By the foregoing examination it appears, that this water is compounded,

1ſt, Of an extreme ſubtil volatile principle, that is very ſoon diſſipated by heat, or by the action of the external air, except when it is very cold.

2dly, An iron earth, or Ochre.

3dly, An alkaline abſorbent earth, of a blueiſh colour like marl.

4thly, An alkaline ſalt.

5thly, An oily bituminous ſubſtance, that forms a pellicle on the top of the water after ſtanding ſome time; which being taken off on an ivory folding knife, has the appearance of leaf gold and ſilver mixed in little patches: and there is much more of this oily ſubſtance in the Bromley water, than in any other Chalybeat I am acquainted with.

6thly, and laſtly, A pure elemental water, in which all the above contents are ſo perfectly diſſolved and incorporated, as not to diminiſh its tranſparency, when the weather is cold. This water will remain clear till the volatile principle begins to evaporate; and, when that effect has taken place, the ſeveral ſaline and other mineral contents, mutually attracting each other, form larger corpuſcles, which firſt diſcover themſelves by rendering the water leſs pellucid; ſoon after it becomes milky, and, in a little while, of a reddiſh yellow; then of a foul dirty yellow, with the appearance of flocky ſubſtances of the ſame colour ſwimming about in it, which very ſoon form into combinations too large and weighty to be ſuſpended; and are, therefore, precipitated in the form of a fine yellow powder: the oily ſubſtance is all this while riſing to the top, where, having formed a pellicle, it remains.

When this ſeparation is perfectly compleated, the water becomes cryſtal-clear again, and it will then no longer be tinged purple with galls: nor does it retain any of its irony taſte, but is a little acrimonious from the alkaline ſalt that ſtill remains in diſſolution in it.

There appears to me ſomething extremely wonderful in the volatile acid ſpirit contained in this and all other volatile Chalybeat waters; by which it is thought their metalline principles are firſt diſſolved, and afterwards kept in an attenuated ſtate. This very fugacious ſpirit is by much too ſubtil to be collected ſo as to become ſubject to the examination of the ſenſes: and I ſuppoſe it is generally believed to be an acid, becauſe iron, and all irony ſubſtances, with which all Chalybeat waters are impregnated, are readily diſſolved by every kind of acids; becauſe it is well known, that the air every where abounds with a very ſubtil acid, by the common Experiment of Alkaline Salt, neutralizing themſelves by attracting an acid out of the air, when they are long expoſed to its influence; and becauſe the Ochre collected from Steel waters and dried, and afterwards expoſed to the air in a vault or other ſubterraneous place, will in time be diſſolved by the acid it attracts out of the air, ſo as to mix with water and conſtitute an artificial Chalybeat water that will be tinged purple with galls.

But of whatever nature this very active fluid may be, it ſeems to me to be altogether incoercible, and not to be retained in the water by any means, except by an intenſe coldneſs of the air.

I know it is by many ſuppoſed, that mixing acids with Chalybeat waters when they are firſt taken up at the ſpring, will preſerve the volatile ſpirit, and keep it from flying off; becauſe when they are ſo mixed, the water remains clear, and no ſeparation or precipitation of its mineral contents enſues, though they are then kept for many months: but I think it cannot from thence be fairly concluded, that the volatile ſpirit is therefore retained in the waters.

For when theſe waters have been kept ever ſo long, and their Ochre and other mineral contents are perfectly precipitated, ſuch precipitated contents are very ſoon diſſolved again by the effuſion of a few drops of Oil or Spirit of Vitriol; and they will be again ſuſpended in the water, which then becomes clear, and, to all appearance, the ſame uniform tranſparent fluid as at firſt; and will ſo remain without any alteration for a great length of time, and the ſmell and taſte and all the ſenſible qualities of ſuch water will be exactly the ſame, as when Acids are mixed with it when it is firſt taken up at the ſpring. And the ſame quantity of Acid that is neceſſary to keep the mineral principles of any Chalybeat water in a ſtate of diſſolution when it is firſt taken up at the ſpring, will readily diſſolve them again after they are perfectly ſeparated from the water, though they have remained in a ſtate of ſeparation ever ſo long. And in both proceſſes the water is deprived of its tinging virtue with galls, till they are neutralized by Alkalies, except when the Acid is ſo nicely proportioned as not to exceed the quantity that is preciſely neceſſary to keep the ſeveral mineral principles of the water in ſolution: and then alſo the effect will be preciſely the ſame in both caſes. So that it does not appear at all probable to me, that the natural, volatile, firſt diſſolving principle, is preſerved in theſe waters by mixing Acids with them, when they are firſt taken up at the ſpring, as it is by many thought to be; eſpecially as their original, clean, ſprightly, vinous flavour, can never be reſtored after ſuch a treatment by any methods, at leaſt, by any that I am acquainted with.

It is, I believe, a pretty general opinion, that Chalybeat waters are impregnated with their iron principle, by a natural vitriolic ſalt of iron, which is generated in the bowels of the earth; and this opinion ſeems to be confirmed by a common obſervation, that theſe waters are ſtronger in wet than in dry weather: from whence it is ſuppoſed, that after much rain, the ſubterraneous waters riſing higher, aſcend up to ſome vitriolic ſtrata, which they could not arrive at in a drier ſeaſon. But this ſuppoſition, though it ſeems very plauſible, yet is very unlikely to be true; for if Chalybeat waters were impregnated by a diſſolution of vitriolic ſalts, it would be eaſy to obtain thoſe ſalts from them again, by the common methods of evaporation, &c. and ſuch ſalts again diſſolved in rain water, would conſtitute a factitious mineral water, that would tinge purple with galls: but no ſuch can be obtained from them. I apprehend the reaſon Chalybeat waters are manifeſtly ſtronger in a rainy than in a drier ſeaſon, is, that then the air, as well as the ſurface of the earth, is colder, by which the mineral fumes being more condenſed, cannot ſo readily diſperſe and fly off, as when the weather is dry and warm: and I, as well as others, have frequently obſerved, that the waters of Tunbridge wells are always ſtronger in cold moiſt weather, and in a morning before the heat of the day comes on, and at night ſome hours after the ſun is down, than in any other part of the day, eſpecially in ſummer; and thoſe waters taken up at the well before ſun-riſe, and ſome hours after ſun-ſet, will ſtrike a deeper purple with galls, and retain their tinging virtue longer, than when they are taken up in the middle of the day: and it is ſaid by thoſe who have made experiments on the hot waters of Bath, and other warm Chalybeats, that they give the higheſt colours with galls, and preſerve their tinging virtue longeſt, in the moſt intenſe froſt; as it is alſo notorious, that all volatile Chalybeats, called Acidulæ, ſuch as thoſe of Tunbridge wells, Iſlington, Sunning-Hill, Bromley, Pyrmont, Pouhon, &c. will do.

It is, therefore, more probable, that Chalybeat waters are impregnated with their iron principle by mineral fumes; by which I mean ſolid particles of metal minutely divided, ariſing from vaſt beds of iron marcaſite, which being condenſed by the coldneſs of the air, are ſtrongly attracted and greedily imbibed by the ſubterraneous waters, which afford a proper vinculum to retain them till the waters break forth, or are brought into the open air; where, being acted on in a warmer medium, their fineſt and moſt active parts being no longer coercible, ſoon evaporate and fly off: and this opinion is agreeable to the ſentiments of the beſt writers on this ſubject; and is further confirmed by the following remarkable particulars.

The firſt is taken from Hoffman's diſſertation on mineral waters, and is a quotation from Liceus Andrea, as follows, viz. "A Chalybeat ſpring, in the dukedom of Wirtemberg, had been long famous for its virtues, and, on a ſudden, loſt all its efficacy: upon inquiry, it was found, that an aperture had been made in the rock, over a cavern, from whence the ſpring iſſued, by ſome workmen digging for ſtone, out of which came forth a very ſtrong mineral fume; and the opening being by order carefully cloſed up, the mineral virtue of the water was again reſtored". And in another diſſertation he ſays, "The waters of a Chalybeat ſpring, about half a mile from Egra, are, in very hot and dry weather, ſo replete with mineral ſpirituous effluvia, that they cannot be drank at the well but muſt be carried to the town to give the volatile vapours time to fly off". Another more modern inſtance of the ſame kind, is related by Dr. Sceppius, in his hiſtory of Pyrmont water; who ſays, " About " eight hundred paces from the mineral water " well at Pyrmont, the labourers, who dig " ſtone in the rocks, were frequently driven " from their work, by mineral fumes that " aroſe from the clefts of the rocks; and that " he himſelf found near the breaches made in " thoſe places, many dead animals, as birds, " mice, ſnakes, &c. which he ſuppoſes were " ſuffocated by the mineral vapours aſcending " through the crannies of thoſe rocks." And as a demonſtration, that the mineral fumes iſſuing from the rocks, and thoſe that impregnate the water, are the ſame; he affirms, that in very dry and hot weather, when the mineral fumes are ſent forth in great plenty, and the mineral water well is near exhauſted, the waiters and people, who then draw the water, are intoxicated by the mineral vapours; and that ducks, geeſe, fiſh, or frogs, thrown into the well at that time, are immediately ſuffocated.

Theſe circumſtances, I think, prove, almoſt to a demonſtration, that volatile Chalybeat waters are impregnated with their metalic principle, by a ſubtil mineral Halitus, or by imperceptible effluvia.

And here we may obſerve by the bye, that according to Dr. Sceppius's account of the Pyrmont water, it is certainly of the number of volatile Chalybeats; which ſhews how abſurd it is to ſuppoſe it can be imported into this kingdom, with its mineral principles in a ſtate of diſſolution, without the aſſiſtance of art.

But to return: perhaps, after all, the preciſe manner, in which theſe waters are enriched with thoſe mineral principles, may never be truly known; and, perhaps, it is no great matter whether they be or no; as ſpeculations of this nature are often more curious than uſeful. I ſhall not therefore give either the reader, or myſelf, any farther trouble on this head, but proceed to what is more to the purpoſe; I mean ſuch an account of the medicinal efficacy of the mineral water at Bromley, as has been confirmed by experience.

And to begin with myſelf. I have drank of this water conſtantly for more than a year, and have received great benefit from the uſe of it: my caſe is a confirmed, inveterate, irregular gout, attended with great variety, as well as ſeverity of ſymptoms. To be particular as to the good effects of this water in my own caſe, my appetite is better, and my digeſtion more perfect; I ſleep longer, leſs interruptedly, and am abundantly more refreſhed by ſleep than I uſed to be; my pains, when I have any, are more in the extremities, and not ſo much in my ſtomach and bowels as uſual; and if I am at all affected in thoſe parts, my pains are ſlight, and of ſhort continuance: if I take cold at any time, the effects of it are leſs ſevere, as well as leſs laſting, than for ſome years before.

It has been ſucceſsfully taken by others, for lowneſs of ſpirits, loſs of appetite, tremors, and all that train of gloomy diſcouraging ſymptoms, that generally go under the denomination of nervous, hyſteric, and hypochondriac complaints; and alſo for intermitting, irregular, and ſlow nervous fevers.

It affords remarkable relief in that uniververſal languor and dejection of ſpirits, conſequent to the gay exceſſes of good fellowſhip.

It has been found very effectual in a weakneſs of ſtomach and bowels, attended with ſickneſs and painful flatulency, the conſequences of bad digeſtion. A perſon, who drank it for a palſey, that affected one ſide of his whole body, or a Hemiplegia, found remarkable relief in a ſhort time: as did another, who had been troubled with a very uncommon convulſive diſorder from her birth, attended with a lameneſs of the limbs of the left ſide, which were alſo greatly emaciated.

A young perſon, who had been troubled with a cough and ſhortneſs of breath, difficult breathing, and other conſequential ails of the meaſles, of three years ſtanding, found a perfect cure by drinking theſe waters every other week for about three quarters of a year:

as did alſo another perſon in the decline of life, that drank them for an habitual cough of many years ſtanding, attended with an entire loſs of appetite, and irregular feveriſh complaints, the conſequences of exceſſive drinking, and other irregularities. I make no doubt but many others have found conſiderable benefit from theſe waters in various caſes, which have not come to my knowledge: for great numbers of people drink them conſtantly, with whom I am not acquainted; and it is very reaſonable to ſuppoſe they find it anſwers ſome very good purpoſe, or elſe they would ſcarcely be at the trouble to come ſo far for them, as many of them do. In this age the generality, eſpecially of the middling and ordinary ſort of people, are not remarkably fond of drinking water, unleſs they find by experience it anſwers ſome very neceſſary and important end. I have deſignedly omitted to make any phyſiological deductions of the medicinal effects of this water, from the materials that are known to enter into its compoſition; as I know how ſubject ſpeculations of that kind are to error, and how difficult it is, if not impoſſible, to aſcertain the operation of any medicinal compoſition on the human body, à priori: I have, therefore, choſe to confine myſelf to the experience I have had by drinking the water myſelf, and, to my own knowledge of its effects on others. But if I may be allowed to indulge a conjecture, which I think is not ill grounded, I ſhould imagine, that by the readineſs with which it diſſolves ſoap, and the alkaline ſalt that is in its compoſition, it is very well calculated to diſſolve bilious concretions, and other ſpiſſitudes of the animal fluids; and to anſwer all the purpoſes of a very powerful and efficacious deobſtruent, in all viſceral obſtructions, more eſpecially of the liver: but this I ſubmit to the public, and experience, to determine. And here I cannot but reflect, with adoration, on the goodneſs of that PROVIDENCE, whoſe mercy is over all his works; who, in compaſſion to our bodily infirmities, has bountifully ſupplied us with an ample number of theſe ſalutary fountains in the neighbourhood of this great metropolis: for, I believe, there is ſcarce a pariſh of any extent, where one or more of them may not be found upon proper inquiry. And if gentlemen of learned profeſſions, and ſtudious employments, and others that are conſtantly engaged in buſineſs in town, and, more eſpecially, thoſe who are paſt the meridian of life, or are now gently declining in the vale of years, would refreſh themſelves with the waters of theſe wholſome ſprings, as often as they retire into the country at any ſeaſon of the year; I am of opinion, they would find ſuch advantages from them, as they themſelves would think a ſufficient inducement to continue to drink them, as often and as long as their affairs would permit.

Some CONSIDERATIONS *concerning the manner of drinking* Chalybeat *waters.*

THE medicinal efficacy of the Bromley water, which is the ſubject of theſe papers, is a very late diſcovery; and there being as yet no phyſician reſiding upon the ſpot, I hope it will be thought a ſufficient apology, for my preſuming to offer to the public ſuch particulars, as I myſelf have found by experience to be uſeful for drinking the Chalybeat water of that ſpring.

But, as the caſes, in which Chalybeat waters are ſucceſsfully preſcribed, are ſo various, and the ſymptoms and degrees of inveteracy of diſeaſes, as well as ſtrength and peculiarity of conſtitution, ſo very different; it would be a very great abſurdity to pretend to give any general rule, to be indiſcriminately obſerved, either as to the quantity of water neceſſary to be taken by each perſon in one day, or the length of time it will be neceſſary to continue to drink it, as theſe circumſtances can only be determined by the peculiarities attending the particular diſeaſe of every ſingle perſon. Some find themſelves remarkably relieved, by drinking theſe waters a few weeks; others are obliged to continue the uſe of them many months; and there are inſtances of perſons, who have been cured of very dangerous and inveterate diſeaſes, by patiently and reſolutely perſiſting

perſiſting in the uſe of them, for one, two, or more years.

I am of opinion, that many, who return unſucceſsful from drinking the water of Tunbridge wells, or other celebrated Chalybeats, have been diſappointed by their own impatience; for if their unreaſonable expectations of finding immediate relief, are not fully and ſuddenly anſwered, they preſently conclude the waters do not agree with them; and if, as it often happens, any untoward ſymptom of their uſual diſorder occurs with ſeverity ſoon after they begin their courſe of drinking, they are ſo confirmed in their prejudice, as ſeldom to be prevailed on to ſubmit to a further trial of the waters; and, for the moſt part, the diſorder, which they imagine was brought on by drinking the waters, has been occaſioned by a preceeding journey, change of air, or by cold taken by ſtaying too late at the rooms in an evening, or ſome other accident, in which the waters were no way concerned.

How very abſurd is it to expect that the effects of a chronic diſeaſe, which has been years acquiring, ſhould be immediately removed, or even its ſymptoms greatly alleviated, in a few days or weeks, by any natural means whatever!

As all Chalybeat waters are found by experience to ſucceed beſt, when they are carried into the minutiæ of the vaſcular ſyſtem, ſo as to promote an equality of circulation through the whole fabric, and to paſs off by inſenſible perſpiration, and other proper excretions;

cretions; the moſt proper time of the day to begin to drink them, is undoubtedly in the morning faſting, uſing ſome conſtant but gentle exerciſe for half an hour between every glaſs, and waiting at leaſt the ſame ſpace of time after the laſt glaſs before you breakfaſt. Between three and four hours after breakfaſt, it will be proper to take another glaſs of water; and thoſe, who drink wine and water at their meals, will do well to drink the mineral, inſtead of common water, at that time; and where it can be done, a large glaſs of the mineral water drank juſt going to-bed, will be found as efficacious, if not more ſo, than at any other time. Thoſe, who, by reaſon of ill health, delicacy, or other peculiarities, are not able to bear the cool morning air, will find their account in drinking the waters at the ſame hours, and in the ſame proportion, in their rooms, uſing ſuch exerciſe as can be ſupported without wearineſs or fatigue; and even, if this for particular reaſons cannot be complied with, they may be taken in the ſame proportion in bed, with very good ſucceſs. The quantity that may be neceſſary to take in one day, may be eſtimated from one pint to four: but, as in ſome caſes, it may be neceſſary even to diminiſh the firſt quantity, ſo in others the laſt may be ſafely exceeded.

The reaſon why I adviſe ſo ſmall a quantity of water to be taken in ſo many hours time, is, becauſe I have often obſerved that when it has been forced down in large quantities, in a little time it frequently acts as a ſtimulus on the firſt paſſage, meerly by its weight; and then it is hurried off by a ſhorter courſe, than is requiſite to anſwer the purpoſes for which it is generally intended. And there is good reaſon to believe, that the drinking Chalybeat waters would be attended with more general ſucceſs, if the ſick could be prevailed upon to drink leſs water at a doſe or in a day, and continue their courſe of drinking longer than the generality are willing to ſubmit to; and, eſpecially, to drink them in the winter as well as the ſummer ſeaſon.

I take the liberty here to mention, by way of admonition, that many who have not been accuſtomed to drink Chalybeat waters, eſpecially the weak and tender, who have been uſed to indulge late in bed, and to eat breakfaſt as ſoon as they are out of it, will find it requires ſome reſolution, as well as time, to acquire a new habit of œconomy, ſo as to make it eaſy to them; and that getting out of bed ſooner than ordinary, going early into the air, faſting longer than uſual, and drinking cold water ſome hours in a morning, will often occaſion complaints of a very diſcouraging nature, till they are a little uſed to it. And theſe complaints are generally miſtaken by the patients themſelves, for a diſagreement of the waters; but a little perſeverance for the moſt part convinces them of their error.

It ſometimes happens, that waters, when drank quite cold from the ſpring, at firſt are ſucceeded by cold chills, or univerſal ſhiverings, or flatulent uneaſineſſes in the bowels: in ſuch caſes it will be neceſſary to mix a ſpoonfull of boiling water in each glaſs, immediately before you drink it; which is a much better method than to warm the Chalybeat water before a fire, in phials cloſe ſtopped, as is ſometimes practiſed; for volatile Chalybeat waters will by no means bear an application of fire, without a manifeſt injury. In ſuch caſes alſo, warm ſeeds or ſpicy aromatics may be chewed, or ſome drops of warm tincture may be taken in the water, as is practiſed with ſucceſs by water-drinkers at the ſeveral celebrated Chalybeat ſprings in the different parts of the world: for my own part, I think Calamus Aromaticus ſliced thin and chewed, or the ſeeds of Cardamom, or their tinctures taken with the water, preferable to any thing of the kind. Sometimes Chalybeat waters render the body coſtive, though the water of the Bromley ſpring has often the contrary effect, even where that indiſpoſition has been habitual and conſtitutional: but whenever it is found productive of ſuch an effect, the inconvenience is beſt removed by ſome very gentle purgative, that is more particularly appropriated to the peculiar diſeaſe of the patient. Another conſequence of drinking theſe waters, eſpecially in bilious habits, is an univerſal itching of the ſkin and general or particular eruptions, which, at beſt, are very troubleſome, and ſometimes very alarming to the patient: but they ſhould never be ſuppreſſed,

ſed, but as much as poſſible encouraged, for they are generally critical and ſalutary; and I have always obſerved in ſuch caſes the criſiſes have been more perfectly and compleatly formed, by continuing to drink the waters under thoſe circumſtances, taking all poſſible care to avoid cold.

Thoſe who drink Chalybeat waters for confirmed gouty, and inveterate chronic rheumatic complaints, eſpecially in debilitated worn-out conſtitutions, will frequently find ſevere and painful returns of their diſorder, during their courſe of drinking: and whenever that happens, and the ſymptoms are painful ſwellings in the extreme parts, either with or without inflammation or redneſs of the pained places, they ſhould by no means deſiſt from drinking the waters for thoſe ſymtoms: for thoſe painful attacks are critical efforts of nature, to throw off ſomething injurious to the conſtitution; and, therefore, ſhould, by all means, be encouraged, by continuing the uſe of the waters, aſſiſted by proper doſes of ſome warm aromatic medicine, ſuch as the Cardiac confection, which I have found to anſwer the purpoſe preferably to moſt others.

I can be more bold and peremptory, in adviſing perſeverance in the uſe of mineral waters, under the foregoing circumſtances; as my own ill health, for many years paſt, has furniſhed me with ample experience of its good effects.

The advice I here give to the gouty patient, to continue drinking the water under pains and penalties, eſpecially as he is to expect from thence, for the preſent, an aggravation of his pain, will, no doubt, be reluctantly, if at all complied with; as pain, tho', according to the Stoics, it is no evil, is yet hard to endure. I muſt own it is a taſk that requires ſome reſolution and fortitude: but though it may, indeed, be here truly objected, that I lead the poor diſpirited cripple in a painful track; yet it will, ſurely, be ſome conſolation to a rational mind, to know he is treading the path that is moſt likely to lead him to a better ſituation.

I ſhall here endeavour to remove an objection, that I have often heard to the drinking Chalybeat waters, from an opinion, that they frequently bring on a fit of the gout.

It is, indeed, true, that thoſe waters do frequently occaſion a paroxyſm of that diſtemper; but they never induce a gouty habit, or a diſpoſition to it, where it was not pre-exiſting in the conſtitution. The truth of the matter, ſo far as I have been able to judge, is this: whenever a fit of the gout has been produced by a courſe of Chalybeat waters, the patient has been conſtitutionally inclined to that diſeaſe, which was either altogether latent before, or had ſhewn itſelf by equivocal ſymptoms, under the appearance of ſome other diſtemper; and the patient, for want of conſtitutional ſtrength, or ſome other cauſe, hath not been able to make an effort powerful enough to form a regular and perfect fit, by throwing off the offended matter upon the extremities: but by the great help theſe valuable waters afford, a regular and legitimate fit of the gout is brought on, which ſeldom fails to recompenſe the patient, by entirely freeing him from thoſe untoward anomalous ſymptoms with which he was before afflicted.

The daily practice of the beſt phyſicians, is an evidence of the truth of what I have ſaid on this ſubject. They frequently ſend their patients to Bath, Tunbridge wells, or other places where there are Chalybeat waters of known efficacy; for no other reaſon, but to procure them a regular fit of the gout, in order to relieve them from ſome other dangerous and threatening diſeaſe: and the ſucceſs juſtifies the practice.

In this ſenſe, only, I think Chalybeat waters can be juſtly chargeable with occaſioning a fit of the gout; and I will leave the reader to judge how far they are prejudicial on that account.

The ſummer is generally eſteemed the beſt time for drinking Chalybeat waters, eſpecially the months of June, July, Auguſt, and September; the weather being then warm, and the air ſerene, and, conſequently, more favourable for uſing the exerciſe that is requiſite in a courſe of mineral waters, than a more advanced ſeaſon.

This I own is no contemptible advantage: but I cannot acquieſce in the opinion, that there are no diſadvantages attending the drinking Chalybeat waters at that ſeaſon, eſpecially in the hotter months; for there are a grea many conſtitutions that cannot bear them at that ſeaſon, but are obliged to diſcontinue the uſe of them, for the very ſame reaſon that thoſe of the ſame temperament are conſtrained to deſiſt from drinking Bath waters on the approach of warm weather: for though one is cold to the touch, and the other is very warm, yet, as a Chalybeat, they both act in the ſame manner on the human body, in proportion to the quantity of iron they reſpectively have in their ſeveral compoſitions. And I believe it will be found on experiment, that the Acidulæ, as they are called, have in general a greater proportion of iron in a given quantity of waters, than the Thermæ.

It ſeems to me, therefore, an abſurdity, to ſuppoſe, that the ſummer ſeaſon only is proper for drinking the former, and the winter for the latter; unleſs it be objected, that warm water is pleaſanter in the winter, and cold in the ſummer; or that the amuſements at the ſeveral places, are reſpectively better adapted to entertain the company.

To ſpeak my mind freely upon this matter; I am of opinion, that Chalybeats in general will be found, upon trial, to agree more univerſally with thoſe who have occaſion to drink them, in the winter than in the ſummer ſeaſon; for the winter brings ſuch advantages to the drinkers of Chalybeat waters, as the ſummer cannot afford, eſpecially in particular caſes. For, beſides that particular habits are not ſo likely to be attended with a plenitude, and all its troubleſome conſequences, by taking them in the winter, as they are in the ſummer; the waters are much ſtronger of the mineral principle in cold than in warm weather; and all volatile Chalybeats, without exception, are beſt in the coldeſt weather, and moſt intenſe froſt. They may alſo be carried many miles diſtant from the ſpring, without ſuffering any ſenſible injury, (as I have often experienced;) which cannot be done in a warm ſeaſon by any means yet diſcovered. So that thoſe, who, for particular reaſons, cannot go to the ſpring, or even out of their rooms, or are confined to their beds, may, in the winter, drink Chalybeat waters at their own houſes, with ſuch ſucceſs as cannot be hoped for or expected in a warm ſeaſon. And thoſe who can venture abroad, and have carriages, or can ride, or walk, may find a great many days proper and agreeable enough for exerciſe without any danger of being over heated by it, as is often the caſe in very warm weather, or incommoded by the cold.

The conſideration, that Chalybeat waters are, for the moſt part, ordered to be drank, to counteract the effects of ſome chronic diſeaſe, will alſo afford a very powerful reaſon, for giving the preference to the winter ſeaſon; as then the ſymptoms of ſuch diſeaſes generally occur with greater ſeverity: and it is very natural to ſuppoſe, that the tender and debilitated ſtand more in need of the aſſiſtance of this noble prophylactic, at that, than at any other time. But there are many, who find no inconvenience at all in drinking Chalybeat waters in the ſummer; eſpecially thoſe, who are paſt the meridian of life: and ſuch of thoſe, who are afflicted with dangerous and inveterate diſeaſes, would do well to drink the waters all the year round; nay, they would find their account in continuing to drink them conſtantly for years. For it is very obvious, from daily experience, how vain it is to expect, that the effects of a chronic diſeaſe, that has been, perhaps, half an age in acquiring, ſhould be removed, by any natural means, in ſo ſhort a ſpace of time as the generality of patients are willing to ſubmit to, in a courſe of mineral waters.

What I have advanced of the ſtrength of Chalybeat waters, in cold weather, the good effects of drinking them in the winter, and the neceſſity of continuing the uſe of them for a very long ſeaſon in obſtinate caſes, is not hypotheſis, or mere conjecture, but the reſult of long experience: for I have drank the waters of Tunbridge wells, the moſt part of four ſummers, and two winters; in the ſummer upon the ſpot, and in the winter at my own houſe, which is 25 miles diſtant from the well. In the very hard froſt of 1752 and 1753, I have thought they were as ſtrong, or ſtronger at home, as far as I have been able to judge, by the deepneſs of the purple they give with galls, and the irony taſte, as I have at any time found them at the well. And, indeed, I had the more convincing proof of their being as efficacious, by receiving the ſame benefit from them in every reſpect, as when I drank them in the ſummer on the ſpot. All the caution that was uſed in filling the bottles to bring home, was to have them corked under water, to exclude the air as much as poſſible, and reſining the corks.

Since the Chalybeat water at Bromley has been diſcovered, viz. ſince September 1754, I have drank of that ſpring daily without intermiſſion, and continue to do ſo ſtill; and, I thank God, I have been better this laſt winter and ſummer, than for ſome years before. I would by no means have it be thought, that I have had no return of pain during that interval; for I have had frequent returns, and ſome ſharp ones too: but they have been more fixed, and in the extreme parts, than for ſome years paſt, with ſwelling and inflammation on the parts, which was not uſual, and which has ſhortened the paroxyſms, and rendered the critical efforts of nature more effectual and deciſive.

I ſhall conclude what I have to ſay on this head, with cautioning all perſons againſt entering on a courſe of theſe waters, without the advice of a ſkilfull phyſician, if they can procure it for money, for friendſhip, or for charity: for though, under proper direction, they are a ſovereign remedy in many dangerous diſeaſes, yet when they are taken at unſeaſonable times, in diſproportionate quantities, without previous preparation, or for complaints in which their uſe is improper, they may be and often are productive of very bad conſequences.

As a diſquiſition into the compoſition of natural Chalybeat waters, has been thought worth the pains of many phyſicians and other eminent perſons; ſo likewiſe the imitation of them by artificial compoſitions, has been recommended, particularly by the great Lord VERULAM. And as artificial Chalybeat waters may probably be of ſome uſe to many; who live very remote from any natural Chalybeat ſpring; or whoſe buſineſs, ill-health, or other circumſtances, will not permit them to be preſent at thoſe places, where ſuch natural waters as are moſt celebrated for their efficacy are to be had; I ſhall give the following plain and eaſy directions for making them.

Take half a drachm of Sal Martis truely prepared, and diſſolve it in one ounce of pure elemental rain or diſtilled water. Mix this diſſolution with thirty pounds of pure rain, or diſtilled water, adding to every pound of water two grains of Salt of Tartar. This will impregnate it as highly with the iron principle as any natural Chalybeat water now in uſe is. But as there are different diſeaſes, and different degrees of inveteracy of the ſame diſeaſe; ſo the water may be made ſtronger or weaker of the mineral principle, by uſing a greater or leſs proportion of the ſolution of Sal Martis, to the ſame quantity of water, as ſhall be judged proper for the particular diſeaſe, conſtitution, or other circumſtances of the patient, either for drinking, or for a warm or cold bath.

If the rain water made uſe of, be ſaved from the ſpout of a dwelling houſe, it will probably have attracted a ſufficient quantity of Alkaline Salt from the mortar on the tiles, and from the ſmoak of the chimney, without the addition of Salt of Tartar; for ſo I have found it will do, by a great many Experiments.

I make no doubt but it will be objected, that the proportion of Sal Martis that I have directed to be uſed in the foregoing proceſs, is by much too ſmall for the great quantity of water; eſpecially as far greater quantities of it are preſcribed to be taken at a doſe, ſeveral times in a day, in the preſent practice of phyſick: to which I anſwer; I only direct ſuch a quantity as I have found, by ſeveral repeated Experiments, to be ſufficient to impregnate the water as highly with the iron principle, as the natural Chalybeat waters that I am acquainted with are, if the iron taſte, and the colour they give with galls, may be allowed a juſt or probable criterion: beſides, I do not deſire the quantity I have directed, ſhould be eſteemed as a ſtandard or a rule not to be departed from; the phyſician alone is the proper judge, when, and in what proportion, to deviate from it.

The imitating natural Chalybeats by artificial mixtures, and the medicating ſuch as are genuine when they are become effete by keeping, I have ſufficient reaſons to believe are very common practices with the dealers in mineral waters: and whoever will be at the trouble to examine the ſeveral mineral waters that are imported, or are ſaid to be imported into this kingdom, by a few experiments carefully attended to, will be perfectly convinced, that he has often drank and payed a good price for Chalybeat waters of ſeveral denominations, that are nothing different from what he himſelf may make, at a very trifling expence, in the manner above directed, mutatis mutandis.

Any perſon that reads the celebrated Hoffman's Experiments upon Pyrmont water, or will take the pains to try analogous Experiments on the natural Chalybeat waters of this kingdom, will ſoon perceive the abſurdity of ſuppoſing, that natural volatile Chalybeats can poſſibly be carried any great diſtance from the ſpring, or even preſerved 24 hours, without being in part or wholly deprived of their medical virtue, by a ſeparation and precipitation of their mineral contents; except in froſty and very cold weather, or unleſs the mineral contents of thoſe waters be preſerved in an attenuated ſtate by the addition of ſome vitriolic or other Acid, or ſome ſaline preparation of iron. Natural Chalybeat waters, when preſerved by ſuch means, are nothing different from the factitious compoſitions before mentioned: for if Steel waters are, when firſt taken up at the ſpring, mixed with vitriolic Acids, in ſuch a proportion only as is neceſſary to preſerve their mineral contents in an attenuated ſtate, without ſuſpending their tinging virtue with galls, which may be done; or if, after they are ſpoiled by an entire ſeparation of their mineral principle, their Ochrey, ſaline, or other contents, are again diſſolved and rendered miſcible with the water, which by the ſame materials may alſo be effected; the caſe is exactly the ſame: and in both theſe proceſſes, an artificial fixed vitriolic ſalt of iron is conſtituted, and added to the water; and, conſequently, is nothing different from an artificial water, compounded with a diſſolution of Sal Martis, Alkaline Salts, and ſuch other fixed mineral contents, in the ſame proportion, as are found in the natural mineral water of the ſame denomination you intend to counterfeit. But any fraud of this kind may be eaſily and infallibly detected, by evaporating a portion of the water to a dryneſs, and diſſolving the reſiduum in pure rain water. Let the diſſolution fine by ſtanding; then pour off the clear part, and give it a double filter; and evaporate again to a pellicle, and ſet the remainder in a cool place to chryſtalize: by this means you will obtain a Salt; and if this Salt diſſolved in pure rain water, will tinge purple with galls, you may certainly conclude the water from whence it was procured to be artificially made, or medicated in the manner before mentioned to preſerve it; for no ſuch Salt can be extracted from natural, unſophiſticated, volatile Chalybeat waters, by any method that has yet been diſcovered.

The univerſal neceſſity of common water for the ſupport of animal life, and the great ſhare it has in every kind of food for the human ſpecies, will, I hope, ſufficiently juſtify me, for offering, in this place, a few particulars concerning that very important fluid.

There is no doubt but the purer this uſeful element is, the better it will be ſuited to anſwer the ſeveral great purpoſes in the animal œconomy, ſo far as nutrition, the circulation of the blood, and the forming the ſeveral ſecretions are concerned: on the contrary, when it is impregnated with particles of matter unqualified for thoſe great and ſalutary ends, it will produce correſponding effects on the fluid and ſolid parts of our bodies, and proportionably influence our health. I ſhall, therefore, endeavour briefly to ſhew, how far the waters moſt generally in uſe in this kingdom, are or are not proper for alimentary purpoſes: which I ſhall do, by pointing out the moſt eaſy methods of diſcovering their unwholſome contents, as well as the moſt effectual means of correcting them, ſo as to obviate their pernicious effects.

The greateſt part of our ſpring and river waters, are impregnated with ſaline, ſtony, and divers kinds of earthy ſubſtances, that are in it in a ſtate of diſſolution, and for the moſt part in conſiderable quantities; which waters are, nevertheleſs, extremely tranſparent, bright, and pellucid. Theſe contents, in proportion to their quantities, give the water a quality that is generally called hard;

which hardneſs proceeds from the acid part of the neutral Salts, and from the Acid that firſt diſſolves the calcarious and other terrene particles, and afterwards keeps them in an attenuated ſtate.

Theſe mineral contents of water are diſcoverable by various means; the moſt common of which are by its weight, fitneſs or unfitneſs for boiling peaſe, and diſſolving ſoap: to which I ſhall ſubjoin the following eaſy methods, viz. 1ſt, boiling the water briſkly for an hour; 2dly, dropping one or two drops of Oil of Tartar into a glaſs of it; or 3dly, the ſame quantity of a ſolution of ſilver in Aqua Fortis; or 4thly, of a ſolution of ſugar of lead, made with pure rain water: by each of theſe methods of trial, the water will turn of a turbid milky colour, in the ſame proportion as it is loaded with ſaline and other mineral contents; more eſpecially by the laſt. It is very ſurprizing to ſee what an alteration is inſtantly induced, by one ſingle drop of this ſolution in a large glaſs of the beſt pump or well water that is generally to be met with; and how large a quantity of ſediment it will depoſit, by ſtanding a few hours after it is thus mixed. The ſaline contents of water are beſt diſcovered, by a drop of a ſolution of ſilver in Aqua Fortis; for the Salt that is generally found in our ſprings, approaches very near to the quality of ſea ſalt, and reſembles it in all its properties; ſo that, when this ſolution is mixed with the water, every particle of the Aqua Fortis that comes in contact with a particle

ticle of the Salt contained in the water, is by it changed into an Aqua Regia, which will then no longer retain the particles of ſilver in diſſolution, which are therefore precipitated in the form of white clouds. Oil of Tartar alſo attracts the Acid out of the neutral Salt, and of the calcarious contents of the water; and then the earthy particles being diſengaged, form firſt white or lightiſh coloured clouds, and then are precipitated in a Calx of the ſame colour. Such waters too become milky by boiling, upon the ſame principle; for the Acid which keeps the calcarious and other earthy matters in diſſolution, becomes volatile by the heat of the fire, and flies off in boiling: the terrene particles being thus diſengaged from their ſolvent principle, attract each other, and form larger corpuſcles, which then become viſible; and being too bulky to be ſuſpended, will on ſtanding be moſtly precipitated to the bottom and ſides of the veſſel, and there form thoſe incruſtations that are commonly ſeen in tea-kettles, and the common boilers uſed at coffee-houſes. The rationale of experiments with ſoap and water, depends alſo on the ſame principle: for the Acid of the mineral contents being attracted by the Alkaline Salts in the ſoap, thoſe ſalts are thereby neutralized, and then they are no longer in a condition to render the oily parts diſſoluble in water; which being, therefore, ſeparated from the ſaline and other contents in the compoſition of ſoap, ſwim on the ſurface of the water, in the form of a dirty greaſy ſcum, which, upon any endeavours to mix it with the water, forms a curd-like appearance in it.

This indiſpoſition of water for certain purpoſes, called hardneſs, is known by almoſt every miſtreſs of a family; and they, without being at all acquainted with chemical principles, as generally know a very eaſy method of correcting it, and mix a quantity of wood aſhes with it, ſome time before they intend to uſe it for waſhing: the Acid in the mineral contents of the water, is neutralized by the Alkaline Salt in the aſhes; and the water is, conſequently, ſofter, and more fit for the purpoſe. Pure elemental water, without any ſaline or earthy contents, ſuch as the pureſt rain water, or diſtilled water, will not curdle with ſoap; but very readily diſſolves it, ſo as to make a clean uniform milky fluid, without any greaſy or oily appearance on the ſurface: nor will either of them ſuffer any alteration by the effuſion of Oil of Tartar, or of the ſolution of ſilver, or that of ſugar of lead.

The beſt and moſt wholſome water for drinking, and other alimentary purpoſes, is diſtilled, and rain water: and, therefore, the beſt and ſafeſt method of correcting the pernicious qualities of ſpring or river water, is by diſtillation, where that can be done; (for I have no opinion of uſing any mixtures for that purpoſe, as they generally cure one infirmity, and cauſe another.) The next beſt method is to boil the water over a briſk fire, for an hour or two; and then let it ſtand in earthen jars, ſome weeks to depurate: by this management all, or the greateſt part of the calcarious and earthy contents, will be depoſited on the bottom and ſides of the jars; and the purified water may be gently drawn off, by cocks conveniently fixed, or by Syphons. Rain water ſaved from the drip or ſpout of a houſe, is much more innocent for internal uſe, than either pond, river, or ſpring water in general is found to be. And it is in almoſt every one's power to obtain a ſufficient quantity of it, not only for drinking, but for brewing, and other family uſes.

People in general conclude, that water is very wholſome and good, if it has no diſtinguiſhing taſte, is very bright and clear, and does not depoſit any great quantity of ſediment, by ſtanding ſome time in a glaſs or decanter, without the application of heat or fire; but either of the above mentioned Experiments, will ſoon convince them of the error of ſuch concluſions, and how little theſe ſpecious appearances are to be depended on.

The extreme minuteneſs into which the particles of ſaline earthy and ſtony ſubſtances found in water, are broken or diſſolved by the univerſal Acid Spirit, ſerves not only to render them inviſible there, but it is to be feared gives them free acceſs into the fineſt veſſels of the human fabric; where being deſerted by the fluid that conveyed them, they remain; and by their angulated form vellicate and twitch the tender veſſels, and excite in them ſpaſmodic affections of various degrees ; which there is too much reaſon to fear, is the cauſe of the great variety of convulſive, ſcorbutic, and rheumatic complaints ; as well as thoſe that paſs under the denomination of hyſteric, hypochondriac, and nervous, ſo frequently to be met with in and about the metropolis, as well as other large and populous cities in this kingdom.

But as the pernicious effects of unwholſome water are ſo elegantly related by the late learned Doctor MEAD, at the end of his excellent book of poiſons ; I cannot, in juſtice to the reader, omit tranſcribing all that the Doctor has there ſaid relative to the ſubject.

The Doctor having treated fully of the ill effects of the various kinds of depravity of the air, towards the end of page 306 of the laſt edition of his eſſay on poiſons, begins thus. " I ſhall, therefore, rather chuſe to " make ſome remarks on the miſchief of ano- " ther fluid, which, as it is the next in uſe " to this we have been treating of, ſo the " bad qualities of it, when it comes to be al- " tered, muſt neceſſarily be almoſt equally " fatal and dangerous.

" I mean water ; which is of ſo conſtant " ſervice, not only for our drinks, but alſo " in preparing our fleſh and bread, that it " may juſtly be ſaid to be the vehicle of all " our nouriſhment : ſo that whenever this " happens to have other properties than are " neceſſary to fit it for this purpoſe, it is no

“ wonder if in its paſſage through the body “ theſe make ſuitable impreſſions there. ”

“ Thus, at Paris, where a part of the city “ is ſupplied with a water from Arcueil, which “ is ſo full of ſtony particles, that even the “ pipes through which it runs, are in time “ incruſted and choaked up; Dr. Liſter has “ obſerved, that the inhabitants are more ſub- “ ject to the ſtone in the bladder, than in “ moſt other places: [Liſter's journey to Paris]

“ In like manner, let the groſs particles “ with which the water is ſaturated, be of any “ other nature, metallic, ſaline, &c. theſe, “ according to their various gravity, the ca- “ pacity of canals, and ſuch like circumſtan- “ ces, will, when they come to circulate in “ the animal body, be by the laws of motion “ depoſited in one part or other. So thoſe “ mineral bodies and nitrous Salts which a- “ bound in the ſnowy waters of the Alps, do ſo “ certainly ſtuff and enlarge the glands of the “ throat in thoſe who drink them, that ſcarce “ any who live there are exempted from this “ inconvenience.

“ For this reaſon, the choice of water for “ drink among the Antients, was by weight; the “ lighteſt being preferred, as being moſt free “ from all heterogeneous bodies.

I ſhall omit what the Doctor has ſaid of poiſonous ſprings, and paſs on to what is more to the preſent purpoſe. “ But as we before took no- “ tice concerning airs, ſo it may be worth while “ to obſerve of waters, that there are ſome “ al-

“ alterations of them, which though not pro-
“ perly poiſonous, yet are of ſo great conſe-
“ quence in their effects, that they may very
“ well deſerve to be regarded.

“ This I ſhall do with reſpect to a great
“ abuſe committed in this kind about the city;
“ and that is in chuſing ſometimes ſtagnating
“ impure well water for the brewing of beer,
“ and making other drinks. Such a fluid in-
“ deed has oftentimes a greater force and apt-
“ neſs to extract the tincture out of malt, than
“ is to be had in the more innocent and ſoft
“ liquor of rivers: but for this very reaſon
“ it ought not, unleſs upon mere neceſſity, to
“ be made uſe of; this quality being owing
“ to the mineral particles and Aluminous Salts
“ with which it is impregnated.

“ A late author, [Dr. J. H. Scelera Aqua-
“ rum: or, a ſupplement to Mr. Graunt on the
“ bills of mortality] by ſearching into the firſt
“ accounts of the diſtemper we call the ſcur-
“ vy, deſcribed by Pliny, (lib. 25. c. 3.) and
“ Strabo, (Geog. lib. 6.) under the promiſcu-
“ ous names of Stomacace and Scelotyrbe;
“ and examining the authentic hiſtories of it in
“ later years, made by the moſt obſerving
“ phyſicians in thoſe countries where it was
“ unhappily revived, as Olaus Magnus, Bal-
“ duinus Ronſeus, J. Wierus, Solomon Al-
“ bertus, &c. finds that the origin of it was
“ in all times and places charged upon the
“ uſe of unwholſome ſtagnating waters. Then,
“ by comparing together the clayey ſtrata of
“ the earth about the cities of London, Paris,

“ and Amſterdam, he ſhews that where the
“ water is worſt there this malady is moſt rife.
“ So that he has put it out of all doubt, that
“ moſt of the perplexed and complicated
“ ſymptoms, which are ranged under this one
“ general name, are in a great degree owing
“ to the ill qualities of this element.

“ And indeed Hippocrates himſelf, as he
“ has very plainly deciphered this diſeaſe
“ (Prorrhet lib. ii. c. 16.) by the title of *σπλῆνες*
“ *μέγαλοι*, or Great Spleens ſo does he very
“ particularly in another treatiſe (De aere aquis
“ et locis, ſub finem) take notice, that drinking
“ of ſtagnating well waters, muſt neceſſarily
“ induce an ill diſpoſition both of the
“ ſpleen and belly.

“ If we enquire into the reaſon of ſuch ill
“ effects, we muſt conſider, that clay is a mineral
“ glebe; and that the groſs particles
“ and metallic Salts, with which waters paſſing
“ through ſuch a bottom abound, are, as
“ Dr. Liſter obſerves, (De fontib. Med. Angl.
“ P. II. p. 75.) not to be maſtered; that is, indigeſtible
“ in the human body. Not only
“ therefore will theſe cauſe, as he very well
“ argues, calculous concretions in the kidnies
“ bladder and joints, and, as Hippocrates experienced,
“ hard ſwellings in the ſpleen; but
“ they muſt neceſſarily oftentimes, by their
“ corroſive quality, twitch and irritate the ſenſil
“ membranes of the ſtomach and bowels,
“ and thus hinder and interrupt the digeſtion
“ of our food. Nay, beſides all this, when
“ they come into the blood, it is no wonder if

the ſmall canals of inſenſible perſpiration are frequently ſtopt. For it is upon this ſcore, that Sanctorius (Med. Static. §. 2. Aphor. 6.) teaches us, that heavy water converts the matter of tranſpiration into an ichor, which being retained induces a cachexy."

" What miſchiefs enſue hereupon every one ſees: not only pains in the limbs, livid ſpots in the ſurface of the body, ulcers, &c. from the acrimony of the undiſcharged moiſture; but many beſides of thoſe nervous complaints, which go by the name of hyſterical, and hypochondraical, may take their riſe from the ſame ſource: for the before cited Sanctorius (§. 3. Aph. 13.) has remarked, that the flatus, or wind ſo inſeparable from thoſe caſes, is no other than the fluid of perſpiration rude and unfiniſhed.

" If theſe inconveniences are oftentimes not felt, at leaſt not till towards the declining age, in ſtrong and active habits of body; yet I am, from very good experience, aſſured, that they deſerve conſideration in weaker conſtitutions and a ſedentary life, eſpecially of the more tender ſex.

" For theſe reaſons Pliny (lib. 31. cap. 3.) tells us, that thoſe waters are condemned in the firſt place, which, when boiled, incruſtate the ſides of the veſſels; and that our well waters do this, no body who looks into the common tea-kettles can be ignorant.

" And indeed, in antient times, as that part of medicine which relates to diet, was more carefully ſtudied than it is now; ſo this point particularly, of

" which we are treating, was of ſo great
" moment, that Hippocrates, (de aere aquis
" et locis) who wrote the beſt book on the
" ſubject that ever was publiſhed, has in a
" great meaſure accounted not only for
" the diſeaſes, but even for the temper and
" diſpoſition of the people of ſeveral coun-
" tries, from the difference of their airs and
" waters.

In a former edition of this book the Doctor has inſerted the following ſhort hiſtory of a caſe, which ſhews in a very remarkable manner the ill effects of unwholſome water.

" I have the honour to be nearly related
" to a worthy perſon, who led formerly an
" afflicted life from the frequent returns of
" violent cholic pains; till ſhe was happily
" adviſed by the noble Van Helmont, not
" to drink (as ſhe then did) beer brewed with
" well water; and her health is even now ſo
" far owing to this management, that an er-
" ror in it is unavoidably followed with the
" wonted complaints".

I ſhall beg leave to add the following remark, from a hint given me by a very ingenious phyſician of my acquaintance: viz. that there is, in moſt waters, Acid enough to corrode and diſſolve lead ſo minutely, as to render it miſcible with the water which is conveyed through pipes made of that pernicious metal; unleſs there ſhould be ſtony or earthy matter enough in ſuch waters, to form incruſtations thick enough to defend them from its effects.

But however it may be in regard to pipes, I have an example of the corroſive effects of the Acid in rain and pump waters, or ſuch as is attracted out of the air, on a leaden ciſtern, which, in about ſixteen years time, is eaten quite through in an infinite number of places, in very ſmall holes, like worm holes in wood. Having related this fact, I leave it to the judgment of the intelligent reader, whether lead is a proper material to be employed for making or lining ciſterns or reſervoirs of water for internal uſe.

Since writing the above, I find Dr. MEAD, in his book of poiſons, mentions it as a remark of Hippocrates, that waters conveyed through leaden pipes are unwholſome. And I have been informed by a plumber of ſome experience in his profeſſion, that the caſe before mentioned, of the ciſtern being corroded, is very common; and that he always finds a white powder, under the old lead on the tops of houſes that has been long expoſed to the weather; and that leaden pipes, that have been laid long in the ground, are always incruſted with a white ſubſtance, that will eaſily crumble between the fingers; and that in ſuch pipes, the metalline part is generally very thin, after that white ſcaly ſubſtance comes off. The ſame plumber informs me, that the fumes ariſing from the old lead, when it is melted for caſting, are much more offenſive and pernicious than thoſe from new lead; and that the worſt and moſt pernicious fumes are produced from the ſcummings of old lead, when they are ſmelted again with ſulphur, and any kind of fat, as is the manner of ſmelting them. He further ſays, he has been ſeveral times in great danger of his life, from ſevere pains in his bowels attended with an obſtinate coſtiveneſs, which he finds himſelf ſubject to as often as he is concerned in new ſmelting the ſcummings of old lead, when it is melted to be new caſt: and he aſſures me, he has been relieved in a moſt extraordinary manner from the before-mentioned ſymptoms, attended with an univerſal trembling and giddineſs, by only drinking the Chalybeat water of the Bromley ſpring a little more than three months; and that he now continues perfectly free from any ſuch complaint.

F I N I S.

The AUTHOR being abſent from the Preſs, the Reader is deſired to excuſe and correct the following typographical Errors.

PAGE 4, l. 13. for *brick-work,* read *ſtone-work.*
P. 7, l. 12. for *effuſion,* read *affuſion.*
ditto l. 13 and l. 17. for *violet* read *violets.*
P. 31, l. 28, for *Acids,* read *Acid.*
P. 32, l. 27, for *effuſion,* read *affuſion,*
P. 34, l. 12, after *ſuch,* add *Salt.*
P. 37, l. 13, for *thoſe,* read *their.*
ditto l. 15, for *they,* read *it.*
P. 43, l. 18, for *the cool morning air,* read *the cool* of the *morning air.*
P. 44, l. 2, for *paſſage,* read *paſſages.*
P. 45. l. 12, for *drops of warm tincture,* read *drops of* ſome *warm tincture.*
P. 48, l. 1. for *offended,* read *offending.*
P. 49, l. 17, for *waters,* read *water.*
P. 50, l. 1, for *attended,* read *affected.*
ditto l. 21, after *days,* add *in winter.*
P. 60, l. 22, for *effuſion,* read *affuſion.*
P. 69, l. 9, after *lead,* add *or.*

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